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SENT VIA FACSIMILE 703/872-9318

September 18, 2002

Toan M. Le, Examiner  
Box PATENT APPLICATION  
Commissioner for Patents  
Washington, DC 20231

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SEP 18 2002  
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3/Response  
P. Walker  
9-20-02

**RE: Application No. 09/853,190**  
**Applicant Tawassul A. Khan (Inventor)**  
**Titled - Mapping Permeable Reservoir Formations by Measuring the**  
**Elastic Nonlinear Interactions of a Seismic Wave as it Propagates**  
**through the Reservoir Rock Matrix and its Pore Fluids.**

Dear Mr. Le:

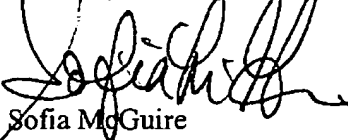
Enclosed is the Reply to USPTO Office Action Summary of July 31, 2002 regarding Application No. 09/853,190.

The write-up has been submitted for the intent of making the patent clearer and the claims have been rewritten and modified to be more specific and to remove any ambiguity of these claims by taking out any 'general' terms. Please reconsider the revised claims; we believe we have reduced any uncertainty due to the generic nature of our previously written claims.

Further, we are resubmitting and rewriting the original claim 9 for consideration. This election to resubmit all 9 claims supersedes the provisional election made by Sofia McGuire on July 23, 2002.

Thank you for your consideration in this matter. Please do not hesitate to contact me at 713/942-7926 with any questions.

Sincerely,

  
Sofia McGuire

**REPLY TO USPTO OFFICE ACTION SUMMARY OF JULY 31, 2002,**  
**RE: APPLICATION NO. 09/853,190**

**Electi n/Restrictions**

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The applicant resubmits the original claim 9 for consideration as a species of the claim that is being submitted. The original claims 1-9 are clarified as follows in italics:

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*A new method for determining in-situ bulk tortuosity of the interconnected pores of reservoir rock, and estimating the bulk permeability of a reservoir formation between seismic transmitters and seismic receivers, such method comprising 1-7 below:*

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1. *Transmit a monofrequency signal generated by a seismic transmitter or seismic transmitters and received by a seismic receiver or seismic receivers.*

2. *Analyze the spectral content of the received signal.*

3. *Identify the side lobes of the monofrequency signal that was transmitted.*

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4. *The frequency of the side lobes represents  $(F - F_{drag})$  and  $(F + F_{drag})$  where  $F$  is the monofrequency and  $F_{drag}$  is the frequency of the 'Drag Wave'. These side lobes are generated due to the elastic nonlinear interaction between the monofrequency wave traveling through the rock matrix and the 'Drag Wave' being generated due to the coupling between the matrix and pore fluids.*

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5. *Calculate the velocity of the 'Drag Wave'  $V_{drag}$  by using the Doppler Effect in which  $F_{drag}/F = V_{drag}/(V - V_{drag})$ ; where  $F_{drag}$  is the frequency of the 'Drag Wave' (see 4 above),  $F$  is the monofrequency,  $V_{drag}$  is the velocity of the 'Drag Wave' and  $V$  is the velocity of the monofrequency signal.*

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6. *The bulk tortuosity of the inter-well reservoir rock formation can be estimated by:  $V_{drag} = V_{fluid}/\sqrt{T}$ , where  $V_{drag}$  is the velocity of the 'Drag Wave',  $T$  is tortuosity, and  $V_{fluid}$  is the compressional velocity of the pore fluids.*

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7. *Once bulk tortuosity has been estimated, bulk permeability can be estimated using Scheidegger's equation  $K = \phi r^2 / 8T$  or other equations generated by Kelder or Peeters.*

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8. *The method of claims 1-7 specifically used to determine in-situ bulk tortuosity of the interconnected pores of reservoir rock, and estimating the bulk permeability of a reservoir formation connected between two wells.*

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9. *The method of claims 1-7 specifically used to determine in-situ bulk tortuosity of the interconnected pores of reservoir rock, and estimating the bulk permeability of a reservoir formation in a well between two depth points in that well.*

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### Sent Via Facsimile

Number of Pages: 13 including cover sheet

TO: Toan M. Le, EXAMINER  
Company: US Patent and Trade Office  
Fax Number: 703/872-9318

CC:  
Fax:

From: Sofia McGuire

Fax Number: 713/521-2873  
Tel. Number: 713/552-2727

Date: 9/18/02 3:44:27 PM

RE: Application No. 09/853,190

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### REMARKS:

Please see attached with changes based upon the Office Action Summary. A hard copy is being mailed today to the Commissioner for Patents. If you have any questions concerning this transmission or the application, please contact me directly at 713/942-7926. Thank you.

Sincerely, Sofia McGuire

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